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STATE OF MISSOURI  
**DEPARTMENT OF NATURAL RESOURCES**

Jeremiah W. (Jay) Nixon, Governor • Sara Parker Pauley, Director

www.dnr.mo.gov

April 11, 2012

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RETURN RECEIPT REQUESTED

**RECEIVED**

**APR 16 2012**

**AWMD/WRAP-KNRP**

Mr. Joseph Haake  
Environmental Scientist  
The Boeing Company  
P.O. Box 516 MC S1112491  
St. Louis, MO 63166-0516

RE: Interim Measures Work Plan Sub-Areas 2B and 6B, The Boeing Company, Tract I  
Hazelwood, Missouri  
EPA ID# MOD000818963

Dear Mr. Haake:

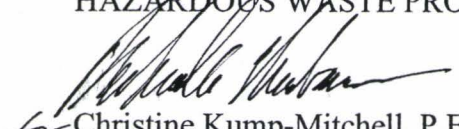
The Missouri Department of Natural Resources (Department), in coordination with the U.S. Environmental Protection Agency (EPA) Region 7, reviewed The Boeing Company's Interim Measures Work Plan Sub-Areas 2B and 6B, dated December 14, 2011. Boeing submitted the document as required by Corrective Action Condition VI.C.2., of Boeing's Missouri Hazardous Waste Management Facility Part I Permit, dated March 5, 1997. The purpose of the document is to propose in-situ chemical oxidation as an interim measure to reduce the mass of chlorinated solvents in two source areas.

We have enclosed comments and requests for additional information for your review and response. You must adequately address these comments before the document can be approved. Please address the individual comments by submitting a written response and three copies of the revised document, to the Department, and two copies to the EPA, within 45 calendar days of receiving this letter.

If you need assistance or have questions regarding this letter or the enclosed comments, please contact me at the Missouri Department of Natural Resources, 7545 South Lindbergh, Suite 210, St. Louis, MO 63125-4839, by telephone at (314) 416-2464 or 1-800-361-4827, or by e-mail at christine.kump@dnr.mo.gov. Thank you.

Sincerely,

HAZARDOUS WASTE PROGRAM

  
for Christine Kump-Mitchell, P.E.  
Environmental Engineer  
Permits Section

CKM:mj

Enclosures

RCRA



516847

Mr. Joseph Haake

April 11, 2012

Page 2

c: Mr. Atul Salahotra, Project Manager, RAM Group  
Ms. Amber Whisnant, Project Manager, U.S. EPA Region 7 ✓  
St. Louis Regional Office, Missouri Department of Natural Resources

### General Comments

1. Boeing must follow all applicable Missouri laws and regulations, including 10 CSR 23-1 to 10 CSR 23-4 that address permitting and reporting of well construction during the implementation of the work plan. Please contact the Missouri Department of Natural Resources' Wellhead Protection Section for more information, if needed, at (573) 368-2165.
2. The work plan should include all of the items identified in the UIC Checklist. Information that has been provided previously in the *Resource Conservation and Recovery Act* Facility Investigation (RFI) or other applicable documents should be either described in the work plan or included in an appendix when possible. Items that are too large to incorporate into the work plan may be referenced, provided sufficient detail is supplied to easily locate the required information in the referenced documents. A copy of the completed UIC Checklist is attached. All of these items must be provided prior to obtaining approval for injection activities. Checklist items not in the current draft work plan include:
  - a) Facility and owner information for the site.
  - b) Cross section of site that includes depth to bedrock, depth to water bearing zone(s), depth of injection, area of soil and groundwater contamination, utilities, septic tanks system, etc.
  - c) Geological features present within a quarter mile radius of site.
  - d) Schematic of injection wells.
  - e) Material Safety Data Sheet (MSDS) for injected material and literature research if biological agents are introduced.
  - f) Volume of chemical to be injected.
  - g) If injected into an aquifer, explain how the injected chemicals will be withdrawn or reduced to pre-injection levels.
  - h) The following information should be collected for each hydraulically distinct zone into which injection is to occur both prior to and following injection: biochemical oxygen demand, chemical oxygen demand, total organic carbon, ammonia as N, groundwater flow velocity, directions, gradients, temperature, and pH.
  - i) A listing of other wells at the site, including active domestic, commercial and industrial use wells, abandoned water wells, aquifer recharge wells, aquifer remediation wells, industrial drainage wells, and others not specifically listed.
  - j) If injection wells are to be cased, a permit or other approval may be required from the Division of Geology and Land Survey.

- k) A geologist or professional engineer registered in Missouri must seal any documents proposing subsurface injection of materials for remediation purposes and/or evaluation of the efficacy of such remediation.
3. There are several design and implementation considerations that must be evaluated while selecting the type of in-situ chemical oxidation to use for remediation of chlorinated hydrocarbons. These include:
- Determine if venting or negative pressure systems are necessary with ozone or Fenton's reagent to accommodate off-gasses and relieve pressure and buildup of organics. This consideration is especially important if the ground surface is paved.
  - Conduct utility surveys to account for the effect of underground piping, utilities, or trenches on preferential pathways and/or pockets of organic decomposition, explosive liquids and vapors, and oxygen.
  - Evaluate the potential impacts Hydrogen Release Compound® (HRC®) may have on in-situ chemical oxidation effectiveness.
  - Address the specific health and safety issues related to using in-situ chemical oxidation and the relationship of the oxidant to chemicals in the soil and groundwater. This would include the need to monitor temperature, pressure, carbon dioxide emissions, and lower explosive limits. These parameters may differ depending on the oxidant selected.

#### **Specific Comments**

4. **Section 1.1 Background and Introduction, Page 1-1:** The introduction should include the facility location and ownership information. In addition to the figures, the work plan should include a more detailed description of the location and ownership information for the two injection sites.
5. **Section 1.1 Background and Introduction, Page 1-1:** This section states "for both sub-areas, in-situ chemical oxidation would be evaluated to destroy the mass of chlorinated solvents in soil and groundwater and to reduce the groundwater concentrations." The work plan does not discuss the type of oxidant that will be used. If Boeing is still in the oxidant selection process, then the work plan should include that fact along with the oxidant options that are being evaluated and a proposal and schedule for submitting the information. Once an oxidant chemical product is selected, the design of the in-situ chemical oxidation procedures should be discussed. This should include the dose of the oxidant required to degrade the contaminant in the sorbed phase, dissolved phase, and if present, the non-aqueous phase liquid, desired radius of influence, the oxidant delivery method, the MSDS of the chemical, and an explanation of how the injected chemical will be reduced to pre-injection levels. Different oxidants will have different design considerations. This information must be submitted prior to obtaining approval for injection activities.

Careful site characterization, screening, and feasibility are necessary to determine the type, amount, and applicability of in-situ chemical oxidation. The conceptual site model as it applies to the selection of oxidants should also be discussed. Because of the reactivity of the oxidants, there is a potential to cause significant changes in both the concentration and distribution of contamination, potentially resulting in large changes in the site's established equilibrium of the contaminants between the vapor, liquid, and sorbed phases. Therefore, it is important to know the concentrations of constituents in the soil and groundwater. It is also important to know what metals are present in the soil and groundwater because in-situ chemical oxidation can oxidize some metals including iron, cadmium, and selenium to a more soluble form, increasing their migration potential. These reactions can also create additional demand of the oxidant and require increased dosing. In addition, manganese concentrations should be determined if permanganate is to be used, as elevated manganese could cause the potential for manganese dioxide precipitation and clogging of aquifer pore space. Additional data needs may be necessary depending on the oxidant chosen. Additional information can be found in the Interstate Technology & Regulatory Council's (ITRC) guidance document entitled "*Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*," dated January 2005.

6. **Section 2 Background Information, Page 2-1:** This section refers to the site-specific references in Section 5 for additional information on localized source areas, geology and hydrogeology, and interim measures. Information that has been provided previously in the RFI or other applicable documents should be either described in the work plan or included in an appendix when possible. However, items that are too large to incorporate into the work plan may be referenced, provided the specific reference for each item is provided in the text.
7. **Section 2.1.6.2, Sub-Area 2B, Deep Groundwater Zone, Page 2-3:** MW-11I and MW-11D are cross-gradient to the source area; there are currently no deep wells downgradient of the Solid Waste Management Unit. Not enough information to state that "the extent of chlorinated solvent impacts has been identified." This statement should be removed.
8. **Section 2.2.5.2, Sub-Area 6B, Deep Groundwater Zone, Page 2-6:** This section states that the deep groundwater zone has not been impacted based on 11 sampling events at MW-9D. MW-9D is located upgradient of MW-3. RC8D has elevated concentrations of total 1,2-dichloroethylene and trichloroethylene. There are no other deep wells in the vicinity of MW-3. This statement should be removed.
9. **Section 3.1 Task 1: Initial Chemical Injection Activities, Page 3-1:** Bench scale or laboratory testing should be conducted as part of Task 1 and prior to conducting injection activities in monitoring well MW-5I in Sub-area 2B and at MW3 and MW3A in Sub-area 6B. Bench scale and laboratory testing are necessary for determining the natural oxidant demand, the soil oxidant demand, and the potential for mobilization of metals. Such testing can be used to quantify treatment efficiencies of chemical oxidants with specific contaminants in both saturated soil and the dissolved phase. Additional

information can be found in the ITRC's guidance document entitled "*Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*," dated January 2005.

10. **Section 3.1.1, Sub-area 2B Phase 1, Page 3-1 and Section 3.1.2, Sub-Area 6B, Phase, Page 3-2:** The work plan should include a figure showing the proposed grid layout of geoprobe borings with an acknowledgement that the number of geoprobe locations are dependent on field screening.
11. **Section 3.1.2, Sub-area 6B, Phase 1, Page 3-2:** This section states that four borings will be cored near MW3 and MW3A to inject oxidants. The work plan should include a figure showing the approximate location of the 4 borings to be cored near MW3 and MW3A.
12. **Section 3.2, Task 2: Monitoring to Evaluate Effectiveness, Page 3-2:** This section states that selected wells will be sampled to determine the effectiveness of the injections. The wells proposed to be sampled should be included, with the acknowledgement that adjustments to the number and location of wells may be needed.

This section also lists parameters that will be analyzed. Additional data need may be necessary depending on the oxidant selected. In addition, depending on the oxidant used, some parameters, such as temperature, pressure, and lower explosive limit, may need to be monitored during oxidant injection. Additional information can be found in the ITRC's guidance document entitled "*Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater*," dated January 2005.
13. **Section 3.3, Task 3: Additional Injection of Chemicals, Page 3-3:** This section states that the exact horizontal and vertical location of injections and the amount of chemical injection will depend on the results of Task 2. The work plan should discuss submittal of an addendum that will provide this information prior to initiating Task 3.
14. **Task 3: Additional Injection of Chemicals, Section 3.3.1, Sub-Area 2B and Section 3.3.2, Sub-Area 6B, Page 3-3:** This section states that selected wells will be sample to determine the effectiveness of the injections. The wells proposed to be sampled should be included, with the acknowledgement that adjustments to the number and location of wells may be needed.

## UIC Checklist

In an effort to comply with the terms of the memorandum between the Hazardous Waste Program (HWP) and the Water Protection Program (WPP) dated September 30, 2004, this checklist has been developed. With my signature at the end of this checklist, I (the site project manager or reviewer) have reviewed the remedial action workplan (and other information submitted for approval of injection activity). A check mark and date beside the required information element indicates satisfactory submittal of that element.

<u>Submitted?</u>	<u>Date</u>	<u>Element</u>
<u>yes</u>	<u>3/12/12</u>	Facility and Owner Information for site
<u>yes</u>	<u>3/12/12</u>	Brief Description of purpose of injection
<u>yes</u>	<u>3/12/12</u>	List of contaminants, highest levels above standards and estimated mass.
<u>yes</u>	<u>3/12/12</u>	Soil type(s)
<u>yes</u>	<u>3/12/12</u>	Depth and volume of soil contamination
<u>yes</u>	<u>3/12/12</u>	Cross section of site that includes depth to bedrock, depth to water bearing zone(s), depth of injection, area of soil and groundwater contamination, utilities, septic tanks system, etc.
<u>yes</u>	<u>3/12/12</u>	Map of site with all pertinent features
<u>yes</u>	<u>3/12/12</u>	Geological features present in 1/4 mile radius of site
<u>yes</u>	<u>3/12/12</u>	Schematic of injection wells
<u>No</u>	<u>3/12/12</u>	MSDS for injected material and literature research if biological agents are introduced. Are these biological organisms already present in soil and at what concentrations?
<u>yes</u>	<u>3/12/12</u>	How many pounds of the chemical will be injected?
<u>yes</u>	<u>3/12/12</u>	If injected into an aquifer, explain how the injected chemicals will be withdrawn or reduced to pre-injection levels? The following information should be collected for each hydraulically distinct zone into which injection is to occur both prior to and following injection: BOD, COD, TOC, Ammonia as N, groundwater flow velocity, directions, gradients, temperature and pH.
<u>yes</u>	<u>3/12/12</u>	A listing of other wells at the site, including active domestic, commercial and industrial use wells; abandoned water wells; aquifer recharge wells; aquifer remediation wells; automobile service station disposal wells, ground source heatpump wells; improved sinkholes; industrial drainage wells; mine backfill wells; and others not specifically listed.
<u>NA</u>	<u>3/12/12</u>	If injection wells are to be cased, a permit or other approval may be required from DGLS.
<u>NA</u>	<u>3/12/12</u>	If the process results in a surface discharge, then a separate Missouri State Operating Permit for such discharge may be required from the Water Pollution Program.
<u>yes</u>	<u>3/12/12</u>	Timetable for injection and a description of the monitoring program to assess the efficacy of the injection. A list of wells to be sampled and sampling methods to be used to analyze soil and groundwater samples to demonstrate the effectiveness of treatment.
<u>yes</u>	<u>3/12/12</u>	Contingency plan for further investigation, remediation and/or analysis of different remedial alternatives if levels do not reach cleanup levels in the time frame predicted. Implementation of the contingency should include further meetings/discussions with the department.
<u>yes</u>	<u>3/12/12</u>	A geologist or professional engineer registered in Missouri should seal any documents proposing subsurface injection of materials for remediation purposes and/or evaluation of the efficacy of such remediation.

Project Manager or Reviewer

Date

3/28/12

Site Name

The Boring Company

will submit  
MSDS once  
contractor is  
selected.